

MEMOTECH
MEMOPAK

I/F

**Centronics Type
Parallel Printer
Interface**

**Read Me First -
Before You Start!**

Hello User,

With this pack we launch you into the world of commercial computer printing and out of the world of silver bus-tickets!

There are now a number of low-cost but powerful commercial printers on the market which can print 80 characters per line or more; we are making a substantial choice of them available with this interface. You can now print in upper or lower case, single or double width, in character or graphics mode.

Which printers can be used with the Centronics Interface?

The first point to make is that "Centronics" refers not to the Centronics printers themselves but to the type of parallel interface common to Centronics and other printers. This has become an industry standard generally referred to as the 'Centronics Interface' and it works with most parallel interface printers. One parallel interface which is not of the Centronics type is the IEEE standard, of which the Commodore Pet printer's interface is the best known example. Our pack cannot be used for the IEEE type interface, but it makes available a good range of printers of the dot-matrix and daisy-wheel types. For the sake of clarity, all the examples in this booklet were written and tested on a Seikosha GP-100A dot-matrix printer.

How do I set up the Centronics Interface pack?

There's nothing to it. Place it behind your ZX81 and plug in. The larger connector is for a memory pack or other standard add-ons. The smaller connector is for the Centronics type printer. You should not try to run a ZX81 printer at the same time. You will have to connect the ribbon cable and plug you require. For a diagram illustrating the pin connections see the back of the booklet.

It is also advisable to re-set the printer before running a program, or to include a blank LPRINT at the start. First, we'll talk about using LPRINT. The interface uses space addressed from 10K up and is therefore compatible with our Hi-Res Graphics pack. With a MEMOPAK 64K you will have to make sure switch 3 is OFF, and operate in MODE B or D. Information about ZX81-ASCII conversion, lower-case, single and double width characters, graphics printing (for example with the MEMOPAK HRG) and COPY and LLIST functions comes later.

How do I use LPRINT?

LPRINT may be used in a number of ways, so we will talk about these separately. Note however that by consulting your printer manual you may find machine-specific ways to control your output.

LPRINT with single strings and LET

At the simplest level, you can LPRINT a line at a time, with each line set up in a string with a LET statement. It's best to set the printer initially with a blank LPRINT to clear the buffer. At the end, the print command (in this case for a Seikosha), will ensure that you have printed everything in your buffer.

```
10 LPRINT
20 LET X$="DEAR JOHN,"
30 LPRINT X$
40 LET Y$="I HOPE YOU ARE
   WELL."
50 LPRINT Y$
60 LPRINT CHR$ 155; "K"
```

Copy

Lines of up to 80 characters can be printed in this way, and any longer strings will continue on the next line.

Note. To ensure single spacing with more than 64 characters on a line, key in

```
LPRINT Y$; CHR$ 155; "A"
```

This will avoid a double line feed.

Actually this example is a wasteful way of coding, because the LET statements cause the characters of the text to be stored twice — once in the instruction file and once in the array file. So let's try INPUT.

LPRINT with single strings and INPUT

INPUT allows you the freedom to decide your text as the program goes along. You need to let the program know when you are finished, so we will use an asterisk as terminator:

```
10 LPRINT
20 INPUT X$
30 IF X$ = "*" THEN GOTO 60
40 LPRINT X$
50 GOTO 20
60 LPRINT CHR$ 155; "K"
```

LPRINT with a string table and INPUT

From here it's a small step to setting up a whole page in your array. The advantage is that you can keep all your text lines simultaneously in memory, and so edit them later. Suppose you want to print 40 lines per page with up to 80 characters per line.

```
10 DIM X$ (40,80)
20 LPRINT
30 PRINT "WHICH JOB?"
40 PRINT "1 = ENTER"
50 PRINT "2 = ALTER"
60 PRINT "3 = PRINT"
70 PRINT "4 = QUIT"
80 INPUT Y
90 CLS
100 IF Y = 1 THEN GOSUB 200
110 IF Y = 2 THEN GOSUB 300
120 IF Y = 3 THEN GOSUB 400
130 IF Y < > 4 THEN GOTO 30
140 STOP
200 FOR X = 1 TO 40
210 INPUT X$ (X)
220 IF X$ (X, 1) = "*" THEN GOTO 240
230 NEXT X
240 RETURN
```

```

300 PRINT "LINE NUMBER"
310 INPUT X
320 PRINT "NEW VERSION"
330 INPUT X$(X)
340 CLS
350 RETURN
400 FOR X = 1 TO 40
410 IF X$(X,1) = "*" THEN GOTO 440
420 LPRINT X$(X); CHR$ 155; "A";
430 NEXT X
440 LPRINT CHR$ 155; "K"
450 RETURN

```

LPRINT with a giant single string

An excellent method is to set up all your text as one long string. The value of this is that you can use the Sinclair EDIT functions to give yourself a simple word processing capability for a whole page. So if you take out or put in an early word in the text, the rest of the text will move along to accommodate the change. The text can also be chopped up for you into sausage-lengths as required. In this case you may also like to include in your program a routine which will prevent your words being split up in an unreadable way. Try the following program.

```

10 LET X$ = "TEXT ■ ETC"
20 PRINT "ENTER MAXIMUM LINE LENGTH"
30 INPUT Z
40 CLS
50 LPRINT
60 IF LEN X$ > Z THEN GOTO 100
70 LPRINT X$;
80 LPRINT CHR$ 155; "K"
90 STOP
100 LET Y = 0
110 IF Y = Z THEN GOTO 60
120 LET Y$ = X$(Z - Y)
130 IF X$(Z + 1 - Y) = " " OR
    X$(Z + 1 - Y) = "■" OR Y$ = "," OR
    Y$ = "." OR Y$ = ";" OR
    Y$ = "?" OR Y$ = CHR$ 11 THEN
    GOTO 170

```

```

140 LET Y = Y + 1
150 GOTO 110
160 LET Y = 0
170 LPRINT X$(TO Z-Y); CHR$ 155;
    "A";
180 LET X$ = X$(Z + 1 - Y TO)
190 IF X$(1) = " " OR X$(1) = "■"
    THEN LET X$ = X$(2 TO)
200 GOTO 60

```

Why not adapt this program to handle multi-page texts?

LPRINT with TAB

The problem with TAB is that it still reduces the column number modulo 32 (divides by 32 and takes the remainder). If you would like to TAB to a higher column number, split your TAB functions into two or more, being careful not to use a column number above 31. So, to get the equivalent of TAB 40 you could key in:

```
LPRINT TAB 31; TAB 9; "HELLO
USER"
```

Well, no doubt you can think of other ways to tailor a program to suit your needs.

Will the pack automatically convert from ZX81 code to ASCII code?

Yes. See back of the booklet for conversion tables for both normal and inverse characters.

Can I use the Sinclair COPY and LLIST functions without any special routines?

Yes. Naturally these will only take up the leftmost 32 print positions, unless you use the double-width character option (see below).

Can I print in lower-case?

Yes. The inverse alpha characters of the Sinclair set will appear on the printed output as lower-case. To save changing mode for the spaces between words, the Sinclair 'inverse' space is printed out as an ordinary blank space.

Can I print double-size characters?

Yes. It will be necessary to precede your Sinclair instructions with the appropriate control code. For example, with a Seikosha, Epsom or NEC printer, you could use:

```
LPRINT CHR$ 155; "E"
```

To return to single-size characters use the control characters CHR\$ 155; "F". Other printers may have different control codes.

What is ASCII?

ASCII stands for the American Standard Code for Information Interchange and is the code expected by commercial printers. For example the byte code 65 will cause the printer to print "A"; 66 will cause "B" etc. See table at the back of the booklet. Exceptionally, the ZX81 has its own code which is not directly compatible with ASCII printers.

Does the Memopak Centronics Interface provide automatic conversion?

Yes. It will convert to most of the standard characters, including all alpha-numerics (including lower-case) and most symbols. Lower-case characters can be obtained from the ZX81 inverse alpha character set. Standard symbols not available in the ZX81 code can be obtained by referring to the required output symbol on the conversion table. For example to print

```
"HELLO USER!"
```

you would need to key in

```
LPRINT "HELLO USER?"
```

What about control codes?

ASCII codes 0-31 are usually used as control codes (e.g. carriage return, line feed etc). These control codes need to be sent to the printer in a

different format. So to send ASCII code 10 (LF) you would need to key:

```
LPRINT CHR$ 155; "A"
```

as shown in the table. Similarly, to send ASCII 27 (ESC) and ASCII 10 (LF), you need:

```
LPRINT CHR$ 155; "R";  
      CHR$ 155; "A"
```

CHR\$ 155 tells the conversion routine that we are dealing with a control code not a literal character.

Using control characters without affecting the print-line

Normally, using a semi-colon or a comma after these LPRINT statements has the same effect as any other LPRINT statement. That is to say, a carriage return or TAB will be automatically generated. You may wish to send control codes but avoid the generation of a carriage return or TAB. In this case, you can terminate the sequence of control characters with a double CHR\$ 155:

```
10 LPRINT CHR$ 155; "E";  
    CHR$ 155; CHR$ 155  
20 LPRINT "ABC"
```

CHR\$ 155; "E" in line 10 tells a Seikosha and similarly organised printers to print in double-width characters. Normally a carriage return would be generated since there is no comma or semi-colon, but in this case only ASCII code 14 is sent to the printer to be followed by "ABC".

Warning: when using any of the CHR\$ 155 functions, both characters must be in the Sinclair buffer at the same time. Just occasionally when the buffer is full the pair will be split between buffers and in this case the function will not work.

How can I send code to the Printer without converting it to ASCII?

There is an alternative way of sending code to the printer. In the example, we're going to send the message

"HELLO BADGER". " BADGER" will be sent in the usual way, but it will be preceded by the "HELLO" sent in the alternative way.

For the new method, the numeric code must be POKEd into a REM statement which must be the first line in the program. 16514 is always the first byte following a first REM statement in a program. The sequence of numbers being POKEd must be terminated by a zero.

```
10 REM      AAAAAA
```

```
20 POKE    16514,72
```

```
30 POKE    16515,69
```

```
40 POKE    16516,76
```

```
50 POKE    16517,76
```

```
60 POKE    16518,79
```

```
70 POKE    16519,0
```

```
80 LPRINT  CHR$6;"  BADGER"
```

The POKE statements replace the A's in the REM statement with the code values for the string "HELLO". This code is then sent to the printer by the graphics control character CHR\$ 6 (found on the T key).

This method is especially useful for sending the machine-specific codes which are associated with values above 127. These will differ from printer to printer and you will need to consult your printer manual.

Remember, however, that the Sinclair printer buffer isn't necessarily transferred to the printer at each LPRINT statement. To ensure printing of characters the double CHR\$ 155 terminator should be used:

```
10 REM AA
```

```
20 POKE 16515,0
```

```
30 FOR X=32 TO 255
```

```
40 POKE 16514,X
```

```
50 LPRINT CHR$ 6; CHR$ 155;  
    CHR$ 155
```

```
60 NEXT X
```

I've also got the Memopak HRG

There are some functions in the

MEMOPAK Centronics Interface
firmware which are for use with the
MEMOPAK High Resolution Graphics
Pack.

If you want to print out the contents of
an HRG video page you need to code
as follows:

```
10 LET V = 19000
20 LPRINT CHR$ 155; "8"
30 LPRINT CHR$ 136
40 LPRINT CHR$ 155; "F"
```

V is the parameter variable for the
start of the video page in memory, as
described in the MEMOPAK HRG
booklet. CHR\$ 155; "8" informs the
Seikosha printer that it is now to print
in graphics mode. CHR\$ 136 tells it to
print out a video page. CHR\$ 155; "F"
returns it to normal printing mode.

There is another special function which
is a general purpose HRG printing
routine. It allows all or part of an HRG
page to be printed on any graphics
printer. It requires six parameters:

V = Start address of video page.

X = Horizontal HRG co-ordinate in range 0–247 of
the top left-hand corner of block to be
printed. This value will automatically be
rounded to the start of the byte area in which
it falls.

Y = Vertical HRG co-ordinate in range 0–191 of
the top left-hand corner of the block to be
printed, counted from base of screen.

E = Width of the block to be printed in bytes, range
1–32.

S = Number of horizontal dot-lines to be printed
(counting down from and including Y).
Maximum value is the number of dots in
depth of the graphics characters of the
particular printer — probably 6, 7 or 8 (7 for
Seikosha).

Q = Constant that needs to be added to a code to
produce the graphics character, usually 0, 32
or 128 (Seikosha = 128).

The special character is CHR\$ 137, so
your code might be, after setting the
parameters:

```
100 LPRINT CHR$ 155; "8"
110 LPRINT CHR$ 137
120 LPRINT CHR$155; "F"
```

With this function, no carriage return

is generated and so it is possible to mix HRG graphics and Sinclair output on the same line.

Note. You may find it quicker to use the graphics character instead of the CHR\$ + value mode. For example, LPRINT "■K" instead of LPRINT CHR\$ 155; "K". A table of those used in this booklet appears below. However, the use of these characters will prevent the normal functioning of LLIST and COPY, since they will activate the printer.

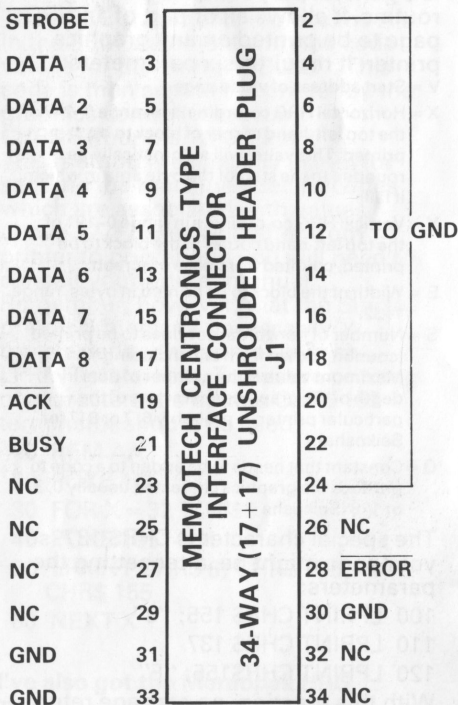
■ CHR\$ 155

▣ CHR\$ 6

▤ CHR\$ 136

▥ CHR\$ 137

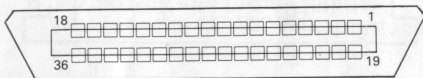
MEMOTECH CONNECTOR



A typical Commercial Printer Connector

Seikosha GP100-A

Use a connector, AMP CHAMP 36 BAIL LOCK TYPE, to input data into the Printer. Pin configuration and its signals of the receptacle in left rear of the Printer are described below. Pins 18 and 36 are not linked.

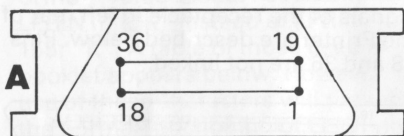


PIN	SIGNAL	PIN	SIGNAL
1	$\overline{\text{STROBE}}$	19	TPG (PAIR WITH 1 PIN)
2	DATA 1	20	TPG (PAIR WITH 2 PIN)
3	DATA 2	21	TPG (PAIR WITH 3 PIN)
4	DATA 3	22	TPG (PAIR WITH 4 PIN)
5	DATA 4	23	TPG (PAIR WITH 5 PIN)
6	DATA 5	24	TPG (PAIR WITH 6 PIN)
7	DATA 6	25	TPG (PAIR WITH 7 PIN)
8	DATA 7	26	TPG (PAIR WITH 8 PIN)
9	DATA 8	27	TPG (PAIR WITH 9 PIN)
10	$\overline{\text{ACK}}$	28	TPG (PAIR WITH 10 PIN)
11	BUSY	29	TPG (PAIR WITH 11 PIN)
12	GND	30	GND
13	NC	31	$\overline{\text{INITIAL}}$ (PAIR WITH 14 PIN)
14	GND	32	$\overline{\text{ERROR}}$ (PAIR WITH 15 PIN)
15	GND	33	GND
16	GND	34	$\overline{\text{CLK}}$ (PAIR WITH 33 PIN)
17	CHASSIS GND	35	$\overline{\text{TEST}}$ (PAIR WITH 16 PIN)
18	+5V 80mA Max.	36	+5V

- NOTES: 1. The combined output of pins 18 and 36 is 80 mA maximum.
2. NC stands for no connection.
3. TPG stands for twisted pair ground.

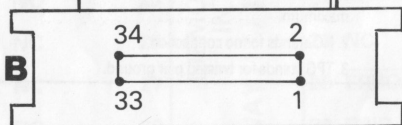
CENTRONICS CABLE CONNECTOR

Plugs into Printer



Pin 1 Connector →

34-WAY RIBBON
CABLE



Plugs into Memopak
Centronics Interface

Connecting the MEMOPAK to the printer

The most convenient cable is an Insulation Displacement Cable (IDC) ribbon made up as in the diagram above, where:

A is a 36-way delta-type plug to the printer

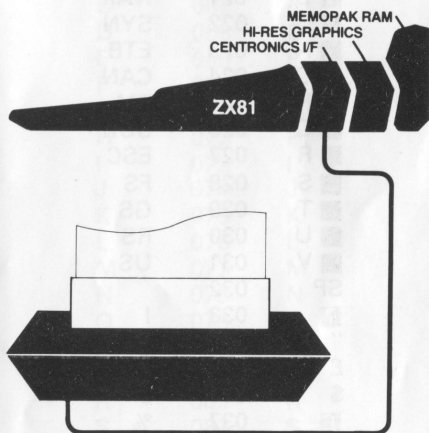
(3M part number 3366-1001)

B is a 34-way low profile header socket to the MEMOPAK interface
(3M part number 3414-6000)

The ribbon cable is 34-way with pins 18 and 36 omitted on plug A.

Socket B is connected to J1 on the Centronics Interface (pin 1 to pin 1).

Plug A is connected to the printer. The above configuration gives a tidy connection which allows other packs to plug on the back with the ribbon cable passing beneath them.



ZX81	CODE	ASCII
0	000	NUL
1	001	SOH
2	002	STX
3	003	ETX
4	004	EOT
5	005	ENQ
6	006	ACK
7	007	BEL
8	008	BS
9	009	HT
A	010	LF
B	011	VT
C	012	FF
D	013	CR
E	014	SO
F	015	SI
G	016	DLE
H	017	DC1
I	018	DC2
J	019	DC3
K	020	DC4
L	021	NAK
M	022	SYN
N	023	ETB
O	024	CAN
P	025	EM
Q	026	SUB
R	027	ESC
S	028	FS
T	029	GS
U	030	RS
V	031	US
SP	032	
?	033	!
"	034	"
£	035	#
\$	036	\$
£	037	%
\$	038	&
'	039	'
(040	(
)	041)
*	042	*
+	043	+
,	044	,
-	045	-

ZX81	CODE	ASCII
.	046	.
/	047	/
0	048	0
1	049	1
2	050	2
3	051	3
4	052	4
5	053	5
6	054	6
7	055	7
8	056	8
9	057	9
:	058	:
;	059	;
<	060	<
=	061	=
>	062	>
?	063	?
+	064	@
A	065	A
B	066	B
C	067	C
D	068	D
E	069	E
F	070	F
G	071	G
H	072	H
I	073	I
J	074	J
K	075	K
L	076	L
M	077	M
N	078	N
O	079	O
P	080	P
Q	081	Q
R	082	R
S	083	S
T	084	T
U	085	U
V	086	V
W	087	W
X	088	X
Y	089	Y
Z	090	Z

ZX81	CODE	ASCII
=	091	[
/	092	/
-	093]
;	094	^
<	095	—
.	096	
A	097	a
B	098	b
C	099	c
D	100	d
E	101	e
F	102	f
G	103	g
H	104	h
I	105	i
J	106	j
K	107	k
L	108	l
M	109	m
N	110	n
O	111	o
P	112	p
Q	113	q
R	114	r
S	115	s
T	116	t
U	117	u
V	118	v
W	119	w
X	120	x
Y	121	y
Z	122	z
(123	{
"	124	
)	125	}
>	126	~
*	127	DEL

FURTHER INFORMATION ON MEMOTECH PRODUCTS

Memotech produce a range of add-on Memopaks for the ZX81. We will be pleased to send information sheets on any of the following packs:

- **Plug-in Keyboard**
- **64K RAM PACK**
- **32K RAM PACK**
- **16K RAM PACK**
- **Hi-Res Graphics**
- **Centronics Type Interface**

**Please
Tick**

<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>
<input type="checkbox"/>

COMING SOON

RS232 Interface

Digitising Tablet

We'll let you know, via our Press advertisements, when information becomes available on the above products.

Please send this page to the address given on the back cover of this leaflet.



MEMOTECH
Explores the
Excellence of your
ZX81

WHY CHOOSE MEMOTECH?

Memotech systems are used not just in the home and in small businesses, but also in larger organisations where localised, efficient data handling is required. We feel this is due to the advantages users gain from the points listed below.

- **reliable and efficient in operation**
- **compact, stylish, high quality extruded aluminium casing**
- **forward compatibility with Memotech products**
- **extensive documentation with sample programs**
- **flexibility of operation modes**
- **full guarantees/refunds or replacement**
- **exchange options (16K)**
- **full after-sales service**
- **efficient quality control**

INSTRUCTION MANUALS

Memotech provide substantial documentation for all their products, in the form of individual booklets for each Memopak. In

addition to basic information on how to use your Memopak the booklets contain program examples and material on the internal architecture and functions plus our guarantee for use in the unlikely event of any malfunction.



Guarantee

April, 1982

This product is guaranteed free from defects in material and workmanship for a period of six months from the date of purchase subject to the following conditions:

- 1. The guarantee does not cover any damage caused through neglect, incorrect adjustment, accident or mis-use and will be invalidated if the product is modified or altered in any way or repaired by anyone other than Memotech Ltd.**
- 2. Claims under this guarantee must be made by sending the product (well packed preferably in its original packing) to the address below.**

Memotech Ltd.,
3 Collins Street,
Oxford,
OX4 1XL.

This Guarantee does not affect the customer's statutory rights.

Model: Centronics Interface

Serial No: (if any).....

Date of Purchase.....

Owner's Name.....

Owner's Address.....

.....

.....

Method of Purchase*.....

Point of Purchase.....

*** Please enclose evidence of purchase (receipt etc) as without this we will be unable to give a refund or replace this item.**

WHAT THEY SAY ABOUT MEMOTECH

"a Rolls Royce add-on."

"The new RAMS from **Memotech** are beautifully designed and blend in really well with the styling of the ZX81."

ZX Computing
Aug/Sept 1982

"The **Memopak** is undoubtedly the ultimate memory expansion for the Sinclair. Try DIM A (9500)!"

"The documentation is good—answering first-time users' questions. It also gives demonstration programs."

Syntax
August 1982

"The 64K version has four switches visible in its rear which allow you to switch out the area between 8K and 16K in the memory map in 4K blocks. This is an excellent idea and I hope other manufacturers will follow this lead . . . Only the **Memotech** allows you to add something between 8K and 16K."

ZX Computing
Aug/Sept 1982

"Anyone who wishes to use his Sinclair for any form of data handling—address lists, stock control, etc., would very quickly run out of space . . . the **Memotech** 64K RAM is designed to overcome this problem."

Hobby Electronics
June 1982

"... there's no denying that the **Memotechs** are the best-styled and the best-made RAM packs on the market."

ZX Computing
Aug/Sept 1982

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